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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 10/040,173
Filing Date: October 23, 2001
Appellant(s): VAIDYANATHAN ET AL.

MAILED
FEB 1 1 2008
GROUP 2800

Robert M. McDermott
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed November 13, 2007 appealing from the Office action mailed June 26, 2007.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

6,337,855	Malkamäki	1-2002
6711412	Tellado	3-2004

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

1. Claims 1,3,5,8,9,14-18,22,24,26,27,29,30,35-39,43,44,48 and 49are rejected under 35 U.S.C. 103(a) as being unpatentable over Malkamäki (US 6,337,855) in view of Tellado (US 6,711,412) .

Claims 1,22.

Malkamäki discloses a system and method for improving performance of wireless communications (see Fig.3), comprising;

a transmitter producing a modulated data signal (2) that includes an addition of a supplemental signal (training sequence) within a monocarrier channel and

a receiver using the supplemental signal to compute a frequency domain channel estimate (11) for use in equalizing the channel (10) during the demodulation.

The claimed invention differs in that the supplemental signal comprises a plurality of frequencies that change during each of a plurality of periods in a predetermined sequence. In other words, the supplemental signal is frequency hopped.

Tellado et al teaches that carrier frequencies for a training signal can be changed in a frequency hopping manner in order to compensate for deep fading and/or interference. See col. 8, lines 42- 53.

Thus, it would have been obvious to one skilled in the art at the time the invention was made to modify the training signal of Malkamäki such that the frequencies of the

training signal change in a frequency hopping manner, as taught by Tellado et al, for the purpose of compensating for deep fading and/or interference.

Claims 3,24.

Since the training signal of Malkamäki is superposed on the modulated data signal, the frequencies of the training signal must be substantially the same and when modified in accordance with Tellado et al, the predetermined sequence should span frequencies within the channel to directly provide a frequency domain channel estimate.

Claims 5,27.

Malkamäki teaches attenuating the power of the training signal to prevent disturbance to the modulated signal. See col. 2, lines 59-65.

Claims 8,14,29,35.

Malkamäki discloses a transmitter (see Fig.3) for improved wireless communications comprising:

a symbol source producing a data signal (data);

a waveform generator for producing a time varying signal (training signal) that is transmitted with a power selected to avoid interference with demodulation of the data signal without reference to the signal; and

a modulator (6) producing a transmission signal from a sum of the data signal and the training signal.

The claimed invention differs in that the time varying signal (training signal) is a time varying signal that changes frequency from one period to a subsequent period in a predetermined sequence. In other words, the time varying signal is frequency hopped.

Tellado et al teaches that carrier frequencies for a training signal can be changed in a frequency hopping manner in order to compensate for deep fading and/or interference. See col. 8, lines 42- 53.

Thus, it would have been obvious to one skilled in the art at the time the invention was made to provide a waveform generator in the Malkamäki's transmitter that produces the training signal whose the frequencies of the training signal change in a frequency hopping manner, as taught by Tellado et al, for the purpose of compensating for deep fading and/or interference.

Claims 9,30.

Since the training signal of Malkamäki is supposed to superposed on the modulated data signal, the frequencies of the training signal must be substantially the same and when modified in accordance with Tellado et al, the predetermined sequence should span frequencies within the channel to directly provide a frequency domain channel estimate.

Claims 15,36.

Malkamäki discloses a receiver and method (see Fig.3) for improved wireless communications comprising:

an equalizer (10) performing channel equalization on a received signal utilizing a channel estimate; and

a coherent demodulator (11) producing the channel estimate from the received signal and a time-varying signal corresponding to a portion of the received signal.

The claimed invention differs in that the time varying signal changes frequency from one period to a subsequent period in a predetermined sequence. In other words, the time varying signal is frequency hopped. Tellado et al teaches that carrier frequencies for a training signal can be changed in a frequency hopping manner in order to compensate for deep fading and/or interference. See col. 8, lines 42- 53.

Thus, it would have been obvious to one skilled in the art at the time the invention was made to provide a waveform generator in the Malkamäki's transmitter that produces the training signal whose the frequencies of the training signal change in a frequency hopping manner, as taught by Tellado et al, for the purpose of compensating for deep fading and/or interference.

Claims 16,17,37,38.

Although not illustrated, the receiver requires a same waveform generator producing the time varying-signal whose period duration and the predetermined sequence match a corresponding period duration and predetermined sequence employed in generating the received signal (at the transmitter) in order to receive the frequency hopping training signal. In other words, when modified as proposed in the above

paragraph, the receiver requires a same frequency hopping frequency generator as one that used in the transmitter.

Claim 18,39.

Since the training signal of Malkamäki is supposed to superposed on the modulated data signal, the frequencies of the training signal must be substantially the same and when modified in accordance with Tellado et al, the predetermined sequence should span frequencies within the channel to directly provide a frequency domain channel estimate.

Claim 43,48,49.

Malkamäki discloses a method (see Fig.3) for using a wireless communication channel signal, comprising;

providing a data signal (data) and

summing at least one supplemental signal (training sequence) with the data signal, wherein the power of the training signal is attenuated to prevent disturbance to the modulated signal. See col. 2, lines 59-65. The summed signals are the ultimate wireless communication signal.

The claimed invention differs in that the supplemental signal frequency changes during each of a plurality of periods in a predetermined sequence. In other words, the supplemental signal is frequency hopped.

Tellado teaches that a training signal has a frequency that changes in a frequency hopping manner in order to compensate for deep fading and/or interference. See col. 8, lines 42- 53.

Thus, it would have been obvious to one skilled in the art at the time the invention was made to modify the training signal of Malkamäki such that the frequencies of the training signal change in a frequency hopping manner, as taught by Tellado et al, for the purpose of compensating for deep fading and/or interference.

Claim 44.

Since the training signal of Malkamäki is superposed on the modulated data signal, the frequencies of the training signal must be substantially the same and when modified in accordance with Tellado et al, the predetermined sequence should span frequencies within the channel to directly provide a frequency domain channel estimate.

(10) Response to Argument

1) Applicant starts to discuss Tellado et al. Applicant explains that Tellado et al teaches carrying a baseband training pattern on a carrier frequency. This examiner quite agrees with this explanation because the examiner also asserted that the training signals are at carrier frequencies in the final Office action. Applicant argues that Tellado et al fails to teach "adding a carrier signal to an input signal" because the patent teaches multiplying a data signal with a carrier signal while the claimed supplemental signals are added to the input data signal. See 2nd paragraph at page 9 of the Brief. However, as Fig.2 of Tellado et al clearly shows, the training

signals (28) are added to the data signal. At col.7:8-12, Tellado et al specifically teaches that training symbols are only transmitted at certain frequencies whereas data are at frequencies between the training symbols. It appears that applicant argues that the supplemental signals are added to an unmodulated baseband input data signal. Claim does not require that the "input data signal" be in the form of unmodulated baseband. Although this feature is disclosed in the specification, one is not supposed to read the specification into claims.

2) Next, applicant argues that, even if Tellado et al's frequency hopping carrier signals are read on the claimed supplemental signals that are added to the input data signals, Tellado et al fails to teach the carrier signals vary during each period **and** also change from one period to the next. Emphasis added. First of all, however, even the specification of the present application fails to disclose the supplemental signals vary during each period **and** also change from one period to the next. It describes that the frequency (of the supplemental signals) hops every 1024 samples. Page 11, lines 14-15. During this period of 1024 samples the frequency does not vary. The phrase "vary during each period" is merely another way of putting "change from one period to the next." Tellado et al clearly teaches that the training signal can be assigned to different carrier frequencies in accordance with a schedule or randomly. See col.8, lines 49-51. The assignment of different frequencies according to a schedule means that a different frequency is assigned during each period in the schedule. In fact, it is the definition of frequency hopping as taught by Tellado et al. As the name of the frequency hopping technique implies, a set of frequencies "hop" or change from one period to subsequent period. In other words, according to the combination of Malkamaki and Tellado et al as proposed in the final Office action, the training sequence will be modulate a plurality of frequencies that vary from

one frequency to another according to a schedule or randomly. Thus modulated plurality of frequencies carrying the training signal are added to the data signal. In sum, the added plurality of frequencies read on the claimed "one or more supplemental signals on a plurality of frequencies" that are added to an input data signal.

3) Applicant further asserts that Tellado et al does not teach "forming a sum of the data signal and this carrier frequency." Last paragraph at page 10 of the Brief. As discussed above Fig.2 col.7:8-12 of Tellado et al show transmitting the data signal and the training signal at different frequencies but at the same time, thus summing the data and training signals. Fig.3 of Malkamaki also shows summing the data signal and a supplemental signal in a similar manner.

4) Lastly, applicant argues that the proposed combination of Malkamaki and Tellado et al will be ineffective for the intended purpose of the combination. In the final Office action, examiner proposed the combination in order take advantage of the frequency hopping which is not subject to deep fading and strong interference that otherwise would have resulted in a fixed carrier frequency for a training signal was used. See col.8:42-53. Applicant fails to establish his benefit is not achievable. Applicant also argues that Malkamaki's channel estimation is performed at baseband after the received signal is demodulated. Wherein the channel estimation is at baseband or at other frequency is irrelevant because such a feature is not claimed. It is noted that Malkamaki does not actually teach channel estimation at baseband. Since the training signal is preferably added at intermediate frequency, the channel estimation may be performed at the intermediate frequency. Moreover, Malkamaki does not exclude adding training sequence at the RF stage, as claim 1 suggests, although it prefers summing of the data and the training signal at the intermediate frequency.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

Kevin Kim: Primary patent examiner at AU 2611

/Kevin / Kim

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